

THE
AMIGA
DIAGNOSTICIAN

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Global Upgrades, Inc.

Part #MAN 18

AMIGA-A500 FAULT FINDING DIAGNOSTIC CHART

SYMPTOMS	U1: 68000 CPU	U6: 315093 ROM	U2: FAT AGNUS	U4: DENISE	U3: PAULA	U5: GARY	U7: 8520	U8: 8520	U9: K/B CHIP	U15: 74LS157	U14: LF347	HY1: VIDEO HYBRID	U34: 74F244	U35: 74F244	U38: 1493	U39: 1489	U37: 74LS32	U40: 74HCT245	U41: 74HCT245	U42: NE555	DRAMS	P.S.U
Blank Screen	•	•	•	•	•							•	•									•
Intermittent Blank Screen	•		•																		•	•
Garbled Letters	•	•	•																			
Graphic Characters		•	•	•																		
Syntax Errors		•																				
DOS Routines		•																				
Expansion Ram			•																			
No Video			•	•							•						•	•				
No DMA Signals			•																			
Different Characters			•																			
Wavy Screen			•																			
No Graphics				•																		
Color Wrong				•																		
No 80 Column				•																		
Resolutions				•																		
Sound Faults				•																		
Control Ports				•																		
Drive R/W				•	•																	
K/B Resoonse					•			•														
Cantronics Port						•	•															
RS232 Port							•							•	•							
Joy Stick Ports						•	•		•													
Mouse Port						•	•															
Drive LED						•																
Memory Faults			•									•	•							•		
Audio Out										•												
No Reset																•			•			
Drive Motor							•	•														

HINTS AND TIPS

Always check the obvious before removing components. For example: Is the Power Supply Unit OK? Is the Disk Drive Unit functioning correctly? Are all leads securely attached? Is the Monitor OK?

Most faults causing the computer not to initialize will be found on one of the custom chips or the CPU or possibly more than one memory chip is down.

Disk drive faults will be located on the drive or one or both of the CIAs, usually. ➡

certain areas of the computer. This will assist you further in the use of the guide. The third section contains all the data charts for each I.C. in the computer and the signals that should be present on each pin. Within this section are details of the Address and Data lines and Video and Sound adjustments. The final section lays out a fault-finding guide to the most common faults.

When faced with a faulty computer, the idea of diagnosing the problem can seem a daunting task. With information of what should be correct in the system, inexpensive and easy-to-use tools, and a guide to the steps to take makes the task seem less daunting. When common sense is used and a logical approach taken, then there is a high probability of finding the fault on the computer.

The tools used with this guide are a logic probe and an inexpensive multimeter. The logic probe used to compile the information in this guide is an Altai (model HYT-07). Any reasonable multimeter can be used for the voltage readings.

USE OF THE LOGIC PROBE

The type of probe used has two leads. The black (-) lead is connected to a convenient "ground" such as the modulator case. The red (+) lead is connected to a +5 volts d.c. supply. A handy place for this is the bottom of L2 (located below and right of the modulator). The metal probe on the main body of the logic probe is then placed on the item to be tested.

THE PULSE SWITCH ON THE PROBE IS PRESSED IN FOR ALL TESTS.

The results of the test are interpreted: where there is a "high" signal expected, a "high" signal should be seen on the probe. There could be activity, or not, on some signals, so there could be variations in the results shown on the probe to that listed in the guide. (This is especially true if a different type of logic probe is used to that used to compile the guide.) The important point is that essentially the results expected are either "high" (5 volts) or "low" (0 volts) and anything opposite to this is incorrect. The pulse element of any signal may not be present if the computer is "dead" as there will not be any activity going on. Signals very different from those listed in the guide should be treated as a suspect.

USE OF THE VOLTMETER (MULTIMETER)

A multimeter, set to the 12 volt d.c. voltage range, can be used instead of the logic probe for most tests. Readings in the clock circuits will not be reliable however. The black (-) lead is connected to the "grounds." The red (+) lead is placed on the item under test. Readings should follow those printed in the guide although an allowance of around ± 0.2 volts may be accepted, as the voltage readings in the guide are only to one decimal place. Again, results very different from those printed should be treated as suspect.

Only a voltmeter is suitable for checking the voltages in the Power Supply circuits. Most of the tests are done with the black (-) lead connected to a "ground." However, some

tests are done across components such as capacitors are the bridge rectifier. When doing these tests on the d.c. components, make sure that the leads are connected to the correct polarity: i.e. black (-) lead to (-) negative side of components and red (+) lead to (+) positive side of component. There is also 9 volts a.c. in these circuits, so when checking the 9 volts a.c., the multimeter requires being switched to the 12 volts a.c. range. Polarity is not important when testing a.c. voltages.

When using both the logic probe and the multimeter, care needs to be taken that adjacent pins on the I.C.s are not accidentally shorted together with the test probe. If this does occur, the computer may "crash." The computer needs to be switched off and switched on again in order to clear this "crash."

The following information was obtained from the records of the [redacted] Office of the Secretary of Defense, Department of Defense, Washington, D.C., dated [redacted].

[The remainder of the page contains extremely faint, illegible text.]

GENERAL INFORMATION

68000 CPU

The 68000 is an advanced 16-bit microprocessor.
The CPU requires a single phase clock input at 8MHz.
The chip operates on a single +5 volts supply.

The Amiga A500 utilizes three custom chips and a control chip. These are:

- U3: FAT AGNUS - Custom Animation Chip (or 8372A Fatter
Agnus Chip)
- U4: 8364 PAULA - Sound and Peripherals Chip
- U5: 5719 GARY - Custom Control Chip

The Kickstart ROM (U6) contains the kernal and DOS routines

The two CIA chips 8520 (U7 & U8) provide the I/O interfacing

The external PSU provides outputs as follows:

- Pin 1: +5 volts
- Pin 2: Shield (GROUND)
- Pin 3: +12 volts
- Pin 4: GROUND
- Pin 5: -12 volts

I.C. TABLE

U1	MC68000	CPU
U2	8370 (8372)	FAT AGNUS (NTSC)
U3	8364	PAULA
U4	8362	DENISE
U5	5719	GARY
U6	ROM	KICKSTART
U7	8520	CIA
U8	8520	CIA
U10, 12	74LS244	OCTAL TRI-STATE NON-INV. BUFFER/LINE DRIVER/RECEIVER
U11, 13	74LS373	OCTAL TRI-STATE D-TYPE LATCH
U14	LF347/TL084	
U15	74LS157	QUAD 2 TO 1 LINE DATA SELECTOR
U16-31	256K X 1 DRAM	DYNAMIC RANDOM ACCESS MEMORY
U32	74F74	DUAL D-TYPE BISTABLE (FAST)
U33	74F04	HEX INVERTER (FAST)
U34, 35	74F244	OCTAL TRI-STATE NON-INV. BUFFER/LINE DRIVER/RECEIVER (FAST)
U36	74LS38	QUAD 2-INPUT o.c.NAND BUFFER
U37	74LS32	QUAD 2-INPUT OR
U38	1488	LINE DRIVER
U39	1489	RECEIVER
U40, 41	74HX245	OCTAL TRI-STATE NON-INV. BUS TRANSCIVER
U42	NE555	

MC68000 CPU

D4	- 1 -	- 64 -	D5
D3	- 2 -	- 63 -	D6
D2	- 3 -	- 62 -	D7
D1	- 4 -	- 61 -	D8
D0	- 5 -	- 60 -	D9
AS	- 6 -	- 59 -	D10
*UDS	- 7 -	- 58 -	D11
*LDS	- 8 -	- 57 -	D12
R/W	- 9 -	- 56 -	D13
*DTACK	-10 -	- 55 -	D14
*BG	-11 -	- 54 -	D15
*BGACK	-12 -	- 53 -	0v
*BR	-13 -	- 52 -	A23
+5v	-14 -	- 51 -	A22
Ø	-15 -	- 50 -	A21
0v	-16 -	- 49 -	+5v
*HALT	-17 -	- 48 -	A20
*RESET	-18 -	- 47 -	A19
*VMA	-19 -	- 46 -	A18
EN	-20 -	- 45 -	A17
*VPA	-21 -	- 44 -	A16
*BERR	-22 -	- 43 -	A15
*IPL2	-23 -	- 42 -	A14
*IPL1	-24 -	- 41 -	A13
*IPL0	-25 -	- 40 -	A12
FC2	-26 -	- 39 -	A11
FC1	-27 -	- 38 -	A10
FC0	-28 -	- 37 -	A9
A1	-29 -	- 36 -	A8
A2	-30 -	- 35 -	A7
A3	-31 -	- 34 -	A6
A4	-32 -	- 33 -	A5

I.C.	I.C. TYPE	DESCRIPTION
U1	MC68000	CENTRAL PROCESSOR UNIT (MICROPROCESSOR)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS	
No.	H	L	P	MET.	TYP		
1	*	*	*	1.9v	D4	DATA-BUS	SEE DATA-BUS CHART
2	*	*	*	2.7v	D3	"	"
3	*	*	*	2.1v	D2	"	"
4	*	*	*	1.7v	D1	"	"
5	*	*	*	1.5v	D0	"	"
6	*	*	*	1.6v	*AS	ADDR. STROBE	U2(24), EXP. P1(74) U5(13), RP101(8)
7	*	*	*	1.9v	*UDS	UP.D. STROBE	U2(53), EXP. P1(72) U5(11), RP101(6)
8	*	*	*	1.9v	*LDS	LO.D. STROBE	U2(52), EXP. P1(70) U5(10), RP101(5)
9	*	*	*	4.5v	R/W	READ/WRITE	U2(22), EXP. P1(68) U5(12), RP101(7) U7(22), U8(22)
10	*	*	*	3.1v	DTACK	*DTACK	R101-U5(43), RP104(2), EXP. P1(66)
11	*	*	*	4.5v	*BG	(SEE NOTES)	EXP. P1(64)
12	*	*	*	5.2v	BGACK	(SEE NOTES)	RP104(4), U5(14) EXP. P1(62)
13	*	*	*	5.2v	*BR	(SEE NOTES)	RP104(5), EXP. P1(60)
14	*	*	*	5.2v	Vcc	+5 VOLTS	+ 5 VOLTS D.C.
15	*	*	*	1.6v	CLK	CLOCK 7MHz	R103(2), RP103-U2(38) U4(35), U2(38)
16	*	*	*	0v	GND	GROUND	
17	*	*	*	5.2v	*HALT	(SEE NOTES)	U5(42), RP101(9) EXP. P1(56)
18	*	*	*	5.2v	*RES	(SEE NOTES)	U2(16), U5(41) RP104(4), U3(11) EXP. P1(53)
19	*	*	*	5.2v	*VMA	(SEE NOTES)	RP102(10), U37(2&5) EXP. P1(51)
20	*	*	*	2.0v	EN	(SEE NOTES)	U7(25), U8(25), EXP. P1(50)
21	*	*	*	5.2v	*VPA	(SEE NOTES)	R102-U5(2), R101(2) EXP. P1(48)
22	*	*	*	5.2v	*BERR	(SEE NOTES)	RP104(3) EXP. P1(46)
23	*	*	*	5.2v	*IPL2	(SEE NOTES)	RP102(9), U3(15) EXP. P1(44)
24	*	*	*	5.1v	*IPL1	(SEE NOTES)	RP102(8), U3(14) EXP. P1(42)
25	*	*	*	5.1v	*IPLO	(SEE NOTES)	RP102(7), U3(13) EXP. P1(40)
26	*	*	*	204m	FC2	(SEE NOTES)	RP102(6), EXP. P1(35)
27	*	*	*	3.2v	FC1	(SEE NOTES)	RP102(5), EXP. P1(33)
28	*	*	*	1.9v	FC0	(SEE NOTES)	RP102(4), EXP. P1(31)
29	*	*	*	2.2v	A1	ADD. LINE	SEE ADDRESS CHART
30	*	*	*	2.4v	A2	"	"
31	*	*	*	2.3v	A3	"	"
32	*	*	*	2.3v	A4	"	"

U1: MC68000 MICROPROCESSOR (CONTINUED)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H/L/P	MET.			TYP	
33	*	*	2.1v	A5	ADD.LINE	SEE ADDRESS CHART
34	*	*	1.6v	A6	"	"
35	*	*	3.3v	A7	"	"
36	*	*	1.8v	A8	"	"
37	*	*	2.0v	A9	"	"
38	*	*	1.6v	A10	"	"
39	*	*	2.9v	A11	"	"
40	*	*	2.5v	A12	"	"
41	*	*	0.8v	A13	"	"
42	*	*	238m	A14	"	"
43	*	*	2.0v	A15	"	"
44	*	*	51mV	A16	"	"
45	*	*	2.0v	A17	"	"
46	*	*	2.7v	A18	"	"
47	*	*	2.6v	A19	"	"
48	*	*	2.6v	A20	"	"
49	*	*	5.2v	Vcc	+ 5 VOLTS	+ 5 VOLTS D.C.
50	*	*	2.6v	A21	ADD.LINE	SEE ADDRESS CHART
51	*	*	2.6v	A22	"	"
52	*	*	2.6v	A23	"	"
53	*	*	0v	GND	GROUND	"
54	*	*	0.6v	D15	DATA LINE	SEE DATA LINE CHART
55	*	*	1.4v	D14	"	"
56	*	*	1.4v	D13	"	"
57	*	*	0.7v	D12	"	"
58	*	*	1.4v	D11	"	"
59	*	*	1.5v	D10	"	"
60	*	*	1.7v	D9	"	"
61	*	*	1.1v	D8	"	"
62	*	*	1.4v	D7	"	"
63	*	*	1.8v	D6	"	"
64	*	*	2.2v	D5	"	"

NOTE

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

I.C.	I.C. TYPE	DESCRIPTION
U2	8370 (NTSC) (8372)	EAT-AGNUS
U2	8371 (PAL)	

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
NO.	H/L/P	MET.			TYPE	
1	*	*	1.2v	DRD13		U13(14), CNX(18), U29(2), U3(44), U4(42) U12(7)
2	*	*	1.2v	DRD12		U12(9), U13(13), CNX(17), U28(2), U3(45) U4(43)
3	*	*	1.5v	DRD11		U12(12), U13(8), CNX(16), U27(2), U3(46) U4(44)
4	*		0v	DRD10		U12(14), U13(7), CNX(15), U26(2), U3(47) U4(45)
5	*	*	4.8v	DRD9		U12(16), U13(4), CNX(14), U25(2), U3(48) U4(46)
6	*	*	3.7v	DRD8		U12(18), U13(3), CNX(13), U24(2), U3(1) U4(47)
7	*	*	5.1v	DRD7		U10(3), U11(18), CNX(12), U23(2), U3(2) U4(48)
8	*		5.1v	DRD6		U10(5), U11(17), CNX(11), U22(2), U3(3) U4(1)
9	*	*	2.7v	DRD5		U10(7), U11(14), CNX(10), U21(2), U3(4) U4(2)
10	*	*	2.0v	DRD4		U10(9), U11(13), CNX(9), U20(2), U3(5) U4(3)
11	*	*	52mV	DRD3		U10(12), U11(8), CNX(8), U19(2), U3(6) U4(4)
12	*	*	2.0v	DRD2		U10(14), U11(7), CNX(7), U18(2), U3(7) U4(5)
13	*	*	240m	DRD1		U10(16), U11(4), CNX(6), U17(2), U3(9) U4(6)
14	*	*	0.9v	DRD0		U10(18), U11(3) CNX(5), U16(2), U3(10) U4(7)
15	*		Vcc	+5 volts		+5 VOLTS D.C.
16	*	*	2.9v	*RST	*RESET	U1(18), U5(41), U3(11) RP104(4), EXP.P1(53)
17	*	*	4.1v	*INT3		U3(17)
18	*	*	102m	DMAL		U3(12)

U2 8370/8371 FAT AGNUS (CONTINUED)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H/L/P	MET.			TYP	
19	*	*	4.4v	*BLIS	*BLISS	U5(19)
20	*	*	3.5v	*BLIT	*BLIT	U5(15)
21	*	*	3.8v	*WE	*WE	U35(17)
22	*	*	4.5v	R/W	READ/WRITE	UI(9), U5(12), EXP.P1(68), RP101(7)
23	*	*	5.1v	*RGEN	*REGEN	U5(18)
24	*	*	1.6v	*AS	*ADD.STROBE	U1(6), U5(13), EXP.P1(74), RP101(8)
25	*	*	3.1v		*RAMEN	U5(20)
26	*	*	3.8v	RGA8		U3(19), U4(10)
27	*	*	3.5v	RGA7		U3(20), U4(11)
28	*	*	3.4v	RGA6		U3(21), U4(12)
29	*	*	3.5v	RGA5		U3(22), U4(13)
30	*	*	3.8v	RGA4		U3(23), U4(14)
31	*	*	3.4v	RGA3		U3(24), U4(15)
32	*	*	3.4v	RGA2		U3(25), U4(16)
33	*	*	3.5v	RGA1		U3(26), U4(17)
34	*	*	1.4v	28mhz	28 MHZ	FB101-X1(8)
35	*	*	136m	XCLK		RP103-U33(12) RP104(2)
36	*	*	5.2v		*XCLKEN	EXTERNAL CLK ENABLE
37	*	*	1.6v	*COAC		U5(26), U33(11) R106(2), U4(34)
38	*	*	1.6v	7mhz	7 MHZ	U1(15), R103(2), RP103-U4(35)
39	*	*	1.7v	CCKQ		U5(27), U33(5), R107(2) U3(29)
40	*	*	1.7v	CCK		U5(28), U33(3), R108(2) U3(28), U4(36)
41	*	*	.7mV		TEST	GROUND
42	*	*	0v	GND	GROUND	
43	*	*	3.1v	DRA0		U34(4)
44	*	*	3.2v	DRA1		U34(8)
45	*	*	3.5v	DRA2		U34(6)
46	*	*	3.4v	DRA3		U34(17)
47	*	*	3.2v	DRA4		U34(15)
48	*	*	3.1v	DRA5		U34(13)
49	*	*	3.3v	DRA6		U34(2)
50	*	*	2.9v	DRA7		U34(11)
51	*	*	2.8v	DRA8		U35(1)
52	*	*	1.9v	*LOS	LO.O.STROBE	UI(8), U5(10), EXP.P1(70), RP101(5)
53	*	*	1.9v	*UDS	UP.O.STROBE	U1(7), U5(11), EXP.P1(72), RP101(6)
54	*	*	3.2v	*CASL		U35(8)
55	*	*	3.2v	*CASU		U35(13)
56	*	*	4.2v	*RAS1		U35(2)
57	*	*	3.1v	*RAS0		U35(15)
58	*	*	0v	GND	GROUND	
59	*	*	2.6v	A19	ADD.LINE	SEE ADDRESS CHART

U2 8370/8371

EAT AGNUS

(CONTINUED)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYP	
60	*	*	*	2.1v	A1	ADD.LINE
61	*	*	*	2.4v	A2	SEE ADDRESS CHART
62	*	*	*	2.3v	A3	
63	*	*	*	2.3v	A4	
64	*	*	*	2.1v	A5	
65	*	*	*	1.7v	A6	
66	*	*	*	3.3v	A7	
67	*	*	*	1.8v	A8	
68	*	*	*	2.0v	A9	
69	*	*	*	1.5v	A10	
70	*	*	*	2.9v	A11	
71	*	*	*	2.5v	A12	
72	*	*	*	0.9v	A13	
73	*	*	*	240m	A14	
74	*	*	*	2.1v	A15	
75	*	*	*	53mV	A16	
76	*	*	*	2.1v	A17	
77	*	*	*	2.7v	A18	
78	*	*	*	5.3v	*LP	(*FIRE 1)
79	*	*	*	5.1v	*VSY	*VSYNC
						CN2(6),U7(9)
						RP403-CN9(12) VIDEO
						U7(19)
80	*	*	*	3.7v	*CSY	*CSYNC
81	*	*	*	4.8v	*HSY	*HSYNC
						U4(32),U41(8&9)
						R402(2),R403-CN9(11)
						U8(19)
82	*	*	*	0v	GND	GROUND
83	*	*	*	1.5v	DRD15	
						U12(3),U13(18),
						CNX(20),U31(2),U3(42)
						U4(40)
84	*	*	*	1.2v	DRD14	
						U12(5),U13(17),
						CNX(19),U30(2),U3(43)
						U4(41)

NOTE

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

I.C.	I.C. TYPE	DESCRIPTION
U4	8362	DENISE

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS	
No.	H	L	P	MET.	TYP		
1	*	*	*	1.6v	D6	DATA LINE	SEE DATA LINE CHART
2	*	*	*	2.0v	D5	"	"
3	*	*	*	1.3v	D4	"	"
4	*	*	*	2.0v	D3	"	"
5	*	*	*	1.8v	D2	"	"
6	*	*	*	1.6v	D1	"	"
7	*	*	*	1.3v	D0	"	"
8				1.9v	M1H		RP405(5), RP404-U15(12)
9				1.8v	MOH		RP405(3), RP404-U15(7)
10	*		*	3.8v	RGA8		U2(26),U3(19),
11	*		*	3.5v	RGA7		U2(27),U3(20)
12	*		*	3.4v	RGA6		U2(28),U3(21)
13	*		*	3.5v	RGA5		U2(29),U3(22)
14	*		*	3.8v	RGA4		U2(30),U3(23)
15	*		*	3.4v	RGA3		U2(31),U3(24)
16	*		*	3.4v	RGA2		U2(32),U3(25)
17	*		*	3.5v	RGA1		U2(33),U3(26)
18	*		*	5.0v	BST	BURST	NOT CONNECTED
19	*			5.2v	Vcc	+5 volts	+5 VOLTS D.C.
20	*	*	*	3.0v	R0		U40(5)
21	*	*	*	3.0v	R1		U40(4)
22	*	*	*	3.0v	R2		U40(3)
23	*	*	*	2.9v	R3		U40(2)
24	*	*	*	2.9v	B0		U41(5)
25	*	*	*	2.9v	B1		U41(4)
26	*	*	*	3.0v	B2		U41(3)
27	*	*	*	3.0v	B3		U41(2)
28	*	*	*	3.0v	G0		U40(9)
29	*	*	*	3.0v	G1		U40(8)
30	*	*	*	3.0v	G2		U40(7)
31	*	*	*	2.9v	G3		U40(6)
32	*		*	3.7v		BLANK	U41(8&9),U2(80)
33	*	*	*	2.7v	Z0	PIXELSW	U41(7)
34	*	*	*	1.6v	*COAC	*COAC	U2(37),U5(26), U33(11),R106(2)
35	*	*	*	1.6v	CKK	7 MHZ	U1(15),R103(2), U2(38)
36	*	*	*	1.7v	CCK		U2(40),U3(28),R108(2), U5(28),U33(3)
37		*		0v	GND	GROUND	
38				1.9v	MOV		RP405(2), RP404-U15(4)
39				1.8v	M1V		RP405(4), RP404-U15(9)
40	*	*	*	1.5v	D15	DATA LINE	SEE DATA LINE CHART
41	*	*	*	1.2v	D14	"	"

U4	8362	DENISE	(CONTINUED)
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PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYPE	
42	*	*	*	1.2v	D13	DATA LINE
43	*	*	*	1.1v	D12	SEE DATA LINE CHART
44	*	*	*	1.4v	D11	
45	*	*	*	1.3v	D10	
46	*	*	*	1.5v	D9	
47	*	*	*	1.3v	D8	
48	*	*	*	1.9v	D7	

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Signals R0 to R3, G0 to G3 and B0 to B3 are connected to U40 and U41 respectively and are part of the color and video functions.

Signals M1H, MOH and MOV, M1V are connected to U15 and are part of the Joystick Port functions.

I.C.	I.C. TYPE	DESCRIPTION
U5	5719	GARY

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.		TYF
1	*			0v GND1	GROUND	
2	*	*		5.2v *VPA		R102-U1(21), R101(2), EXP.P1(50)
3	*	*		4.8v *DEL		U11(1), U13(1)
4	*	*		4.8v *DEB		U10(1&19), U12(1&19)
5	*			5.2v	*KBRESET	Q711(3), RP501(5)
6	*			5.2v Vcc1	+5 volts	+5 VOLTS D.C.
7	*			5.2v *MTR		U8(17)
8		*		158m DKWE		U3(39)
9	*			4.1v *DKWD		U3(38)
10	*	*	*	2.0v *LDS	LO.D.STROBE	U1(8), U2(52), RP101(5), EXP.P1(70)
11	*	*	*	1.9v *UDS	UP.D.STROBE	U1(7), U2(53), RP101(6), EXP.P1(72)
12	*	*		4.5v R/W	READ/WRITE	U1(9), U2(22), RP101(7), EXP.P1(68)
13	*	*	*	1.7v *AS	ADD.STROBE	U1(6), U2(24), RP101(8), EXP.P1(74)
14	*			5.2v	*BGACK	U1(12), RP104(4) EXP.P1(62)
15	*	*		3.5v *BLIT		U2(20)
16	*	*		5.2v *SELO		U8(13)
17	*			5.2v Vcc2	+5 volts	+5 VOLTS D.C.
18	*	*		5.2v	*REGEN	U2(23)
19	*	*		4.4v	*BLISS	U2(19)
20	*	*	*	3.1v	*RAMEN	U2(25)
21	*	*	*	3.4v	*ROMEN	U6(12)
22	*			5.2v	*CLKRD	CNX(49)
23	*			5.2v	*CLKWR	CNX(50)
24		*		0v GND2	GROUND	
25	*	*	*	2.5v	*LATCH	U11(11), U13(11)
26	*	*	*	1.6v	*COAC	U2(37), U4(34), U33(11), R106(2)
27	*	*	*	1.7v CCKQ		U2(39), U3(29), U33(5), R107(2)
28	*	*	*	1.7v CCK		U2(40), U3(28), U4(36) U33(3), R108(2)
29	*			5.2v *OVR		RP104(7), EXP.P1(17)
30		*		16mV OVL		U7(2)
31	*			5.2v XRDY		RP104(6), EXP.P1(18)
32	*			5.2v	*EXRAM	CNX(32)
33	*	*	*	2.0v A17	ADD.LINE	SEE ADDRESS CHART
34	*	*	*	2.6v A18	"	"
35	*	*	*	2.6v A19	"	"
36	*	*	*	2.7v A20	"	"
37	*	*	*	2.5v A21	"	"
38	*	*	*	2.6v A22	"	"

U5 5719 GARY (CONTINUED)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS	
No.	H	L	P	MET.	TYP		
39	*	*	*	2.6v	A23	ADD.LINE	SEE ADDRESS CHART
40		*		0v	GND3	GROUND	
41	*			5.2v	*RST	*RESET	U1(18),U2(16),U3(11)
							RP104(4),EXP.P1(53)
42	*			5.2v	*HLT	*HALT	U1(17),RP101(9),
							EXP.P1(55)
43	*	*	*	2.9v		*DTACK	R101-U1(10),
							RP104(2),EXP.P1(66)
44		*		3mV		DKWEB	U36(13)
45		*		3mV		DKWDB	U36(10)
46		*		6mV		MTRON	U36(5)
47		*		3mV		MTRX	U36(2)
48	*			5.2v	Vcc3	+5 volts	+ 5 VOLTS D.C.

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Control Signals associated with U5 GARY are on pins :

2,3,4,10,11,12,13,14,15,18,19,20,21,22,23,25,26,27,28,29,30,-
31,32,33,34,35,36,37,38,39,41,42 & 43

Floppy Functions associated with U5 GARY are on pins :

5,7,8,9,16,44,45,46 & 47

+5 Volts is supplied to the chip on pins :

6,17 & 48

The following pins are connected to Ground :

1,24 & 40

I.C.	I.C. TYPE	DESCRIPTION
U6	315093	KICKSTART ROM

FIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYP	
1						
2	*	*	*	1.8v	A7	ADD. LINE SEE ADDRESS CHART
3	*	*	*	3.3v	A6	"
4	*	*	*	1.6v	A5	"
5	*	*	*	2.1v	A4	"
6	*	*	*	2.3v	A3	"
7	*	*	*	2.3v	A2	"
8	*	*	*	2.4v	A1	"
9	*	*	*	2.1v	A0	"
10		*		0v	GND	GROUND
11		*		0v		
12	*	*	*	3.4v	OE	*ROMEN U5(21)
13	*	*	*	1.5v	D0	DATA LINE SEE DATA LINE CHART
14	*	*	*	1.0v	D8	"
15	*	*	*	1.7v	D1	"
16	*	*	*	1.7v	D9	"
17	*	*	*	2.1v	D2	"
18	*	*	*	1.5v	D10	"
19	*	*	*	2.7v	D3	"
20	*	*	*	1.4v	D11	"
21	*			5.2v	Vcc	+5 volts +5 VOLTS D.C.
22	*	*	*	1.9v	D4	DATA LINE SEE DATA LINE CHART
23	*	*	*	0.7v	D12	"
24	*	*	*	2.2v	D5	"
25	*	*	*	1.4v	D13	"
26	*	*	*	1.8v	D6	"
27	*	*	*	1.4v	D14	"
28	*	*	*	1.4v	D7	"
29	*	*	*	0.6v	D15	"
30		*		0v		
31	*	*	*	2.6v	A17	ADD. LINE SEE ADDRESS CHART
32	*	*	*	2.0v	A16	"
33		*	*	49mV	A15	"
34	*	*	*	2.0v	A14	"
35	*	*	*	240m	A13	"
36	*	*	*	0.9v	A12	"
37	*	*	*	2.5v	A11	"
38	*	*	*	2.9v	A10	"
39	*	*	*	1.5v	A9	"
40	*	*	*	2.0v	A8	"

I.C.	I.C. TYPE	DESCRIPTION
U7	8520	COMPLEX INTERFACE ADAPTER (CIA) [ODD]

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYP	
1	*			0v		
2	*			16mV PA0	OVL	U5(30)
3	*			82mV PA1	*LED	RS03-Q502(2), RS05(2)
						U38(2)
4	*			5.1v PA2	*CHNG	CN11(2), CN5(11)
5	*			5.1v PA3	*WPROT	CN11(28), CN5(14)
6	*			5.1v PA4	*TRKO	CN11(26), CN5(15)
7	*			5.1v PA5	*RDY	CN11(34), CN5(1)
8	*			5.1v PA6	*FIRE0	CN1(6), C411(1)
9	*			5.1v PA7	*FIRE1	CN2(6), C421(1), U2(78)
10	*			5.1v PB0	PPD0	CN7(2)
11	*			5.1v PB1	PPD1	CN7(3)
12	*			5.1v PB2	PPD2	CN7(4)
13	*			5.1v PB3	PPD3	CN7(5)
14	*			5.1v PB4	PPD4	CN7(6)
15	*			5.1v PB5	PPD5	CN7(7)
16	*			5.1v PB6	PPD6	CN7(8)
17	*			5.1v PB7	PPD7	CN7(9)
18	*			5.2v *PC	*STROBE	RP501(10), CN7(1)
19	*			5.1v TICK	*VSYNC	U2(79), RP403-CN9(12)
20	*			5.2v Vcc	+5 volts	+5 VOLTS D.C.
21	*			5.2v *INT	*INT2	RP501(9), U3(16),
						EXP.P1(19)
22	*	*		4.5v *H	R *H	U8(22), U1(9), U5(12)
						RP101(7), EXP.P1(68)
23	*	*		4.3v *CS		U37(3)
24	*			5.1v *F	*ACK	RP501(6), CN7(10)
25	*	*	*	2.0v E		U8(25), U1(20),
						EXP.P1(50)
26	*	*	*	1.4v D7	DATA LINE	SEE DATA LINE CHART
27	*	*	*	1.8v D6	"	"
28	*	*	*	2.2v D5	"	"
29	*	*	*	1.9v D4	"	"
30	*	*	*	2.7v D3	"	"
31	*	*	*	2.0v D2	"	"
32	*	*	*	1.7v D1	"	"
33	*	*	*	1.5v D0	"	"
34	*			4.4v	*RESET	U8(34), U37(11)
35	*	*	*	2.9v RS3	A11	SEE ADDRESS CHART
36	*	*	*	1.5v RS2	A10	"
37	*	*	*	2.0v RS1	A9	"
38	*	*	*	1.8v RS0	A8	"
39	*			5.1v S	*KBCLOCK	RP501(3), CN13(2)
40	*			5.1v C	*KBDATA	RP501(2), CN13(1)

CN1 : LEFT J/STICK PORT
 CN5 : EXTERNAL FLOPPY PORT
 CN9 : VIDEO PORT
 CN13: KEYBOARD PORT

CN2 : RIGHT J/STICK PORT
 CN7 : CENTRONICS PORT
 CN11: INTERNAL FLOPPY PORT

I.C.	I.C. TYPE	DESCRIPTION
U8	8520	COMPLEX INTERFACE ADAPTER (CIA) [EVEN]

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYPE	
1	*			0v		
2	*			5.1v	PA0	BUSY - U8(39), CN7(11)
3	*			5.1v	PA1	POUT U8(40), CN7(12)
4	*			5.1v	PA2	SEL - RP501(4), Q501(3), CN7(13)
5	*			5.1v	PA3	U39(8)
6	*			5.1v	PA4	U39(6)
7	*			5.1v	PA5	U39(11)
8	*			5.1v	PA6	U38(4)
9	*			5.1v	PA7	U38(12)
10	*			5.1v	PB0	*STEP CN5(18), CN11(20)
11	*			5.1v	PB1	DIR CN5(19), CN11(18)
12	*			5.1v	PB2	*SIDE CN5(13), CN11(32)
13	*			5.1v	PB3	*SELO CN11(10)
14	*			5.1v	PB4	*SEL1 CN5(21), CN11(12)
15	*			5.1v	PB5	*SEL2 CN5(9),
16	*			5.1v	PB6	*SEL3 CN5(20),
17	*			5.1v	PB7	*MTR
18						NOT CONNECTED
19	*	*		4.8v	TICK	*HSYNC U2(81), R402(2), R403-CN9(11)
20	*			5.2v	Vcc	+5 volts +5 VOLTS D.C.
21	*			5.2v	*INT	*INT6 U3(18), RP501(8), EXP.P1(22)
22	*	*		4.5v	*W	R *W U7(22), U1(9), U5(12), RP101(7), EXP.P1(68)
23	*	*		4.3v	*CS	U37(6)
24	*			5.1v	*F	*INDEX RP501(7), CN5(22), CN11(8)
25	*	*	*	2.0v	E	U7(25), U1(20), EXP.P1(50)
26	*	*	*	1.4v	D7	DATA LINE SEE DATA LINE CHART
27	*	*	*	1.4v	D6	"
28	*	*	*	1.4v	D5	"
29	*	*	*	0.7v	D4	"
30	*	*	*	1.4v	D3	"
31	*	*	*	1.5v	D2	"
32	*	*	*	1.7v	D1	"
33	*	*	*	1.0v	D0	"
34	*			4.3v	*RST	*RESET U7(34), U37(11)
35	*	*	*	2.9v	RS3	A11 SEE ADDRESS CHART
36	*	*	*	1.5v	RS2	A10
37	*	*	*	2.0v	RS1	A9
38	*	*	*	1.8v	RS0	A8
39	*			5.1v		BUSY U8(2), CN7(11)
40	*			5.1v		POUT U8(3), CN7(12)

CN5 : EXTERNAL FLOPPY PORT

CN7 : CENTRONICS PORT

CN9 : VIDEO PORT

CN11: INTERNAL FLOPPY PORT

PINS: 5, 6, 7, 8 & 9 are associated with the RS232 SERIAL PORT

I.C.	I.C. TYPE	DESCRIPTION
U3	8364	PAULA

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H/L/P	MET.			TYP	
1	*	1.3v	D3	DATA LINE		SEE DATA LINE CHART
2	*	1.3v	D7	"		"
3	*	1.6v	D6	"		"
4	*	2.0v	D5	"		"
5	*	2.1v	D4	"		"
6	*	2.0v	D3	"		"
7	*	1.8v	D2	"		"
8	*	0v	GND	GROUND		
9	*	1.6v	D1	DATA LINE		SEE DATA LINE CHART
10	*	1.3v	D0	"		"
11	*	5.2v	*RES	*RESET		U1(18), U3(11), U5(41) RP104(4), U2(16)
12	*	102m	DMAL			U2(18)
13	*	5.1v	*IPLO			U1(25), RP102(7), EXP.P1(40)
14	*	5.1v	*IPL1			U1(24), RP102(8), EXP.P1(42)
15	*	5.2v	*IPL2			U1(23), RP102(9), EXP.P1(44)
16	*	5.2v	*INT2			RP501(9), U7(21) EXP.P1(19)
17	*	4.1v	*INT3			U2(17)
18	*	5.2v	*INT6			RP501(8), U8(21), EXP.P1(22)
19	*	3.8v	RGA8			U2(26), U4(10)
20	*	3.5v	RGA7			U2(27), U4(11)
21	*	3.4v	RGA6			U2(28), U4(12)
22	*	3.5v	RGA5			U2(29), U4(13)
23	*	3.8v	RGA4			U2(30), U4(14)
24	*	3.4v	RGA3			U2(31), U4(15)
25	*	3.4v	RGA2			U2(32), U4(16)
26	*	3.5v	RGA1			U2(33), U4(17)
27	*	5.0v	Vcc	+5 volts		+5 VOLTS D.C.
28	*	1.7v	CCK			U2(40), U4(36), U5(29) U33(3), R108(2)
29	*	1.7v	CCKQ			U2(39), U5(27), U33(5) R107(2)
30		2.5v	AUD B	RIGHT		R339(2), U14(9), R331(1), C331(1)
31		2.5v	AUD A	LEFT		U14(13), R321(1), C321(1)
32	*	4.1v	P0X	POTOX		C311(2), C413(1), CN1(5)
33	*	4.1v	P0Y	POTOY		C312(2), C412(1), CN1(9)
34	*	0v	GND	GROUND		
35			P1X	POT1X		C313(2), C423(1), CN2(5)

U3 8364 PAULA (CONTINUED)

PIN	L/PROBE	VOLT	LABEL	DETAILS	SIG	CONNECTIONS
No.	H	L	P	MET.	TYE	
36				P1Y	POT1Y	C314(2), C422(1), CN2(9)
37	*			5.2v	*DKRD	R305(1), CN5(2)
38	*			4.1v	*DKWD	U5(9)
39		*		158m	DKWE	U5(8)
40	*			4.1v	*TXD	U38(9)
41	*			5.2v	*RXD	U39(3)
42	*	*	*	1.5v	D15	DATA LINE
43	*	*	*	1.2v	D14	"
44	*	*	*	1.2v	D13	"
45	*	*	*	1.2v	D12	"
46	*	*	*	1.4v	D11	"
47	*	*	*	1.3v	D10	"
48	*	*	*	1.5v	D9	"

NOTES

Pin numbers that have an asterisk with their label name are signals that are switched on and are active when the signal is in a " low " state.

Pin numbers without an asterisk to their label name are signals that are active in a " high " state.

Signals POTOX, POTOY, are inputs to the LEFT Joystick Control Port (CN1).

Signals POT1X, POT1Y, are inputs to the RIGHT Joystick Control Port (CN2).

Signals *DKWD, DKWE, are connected to U5 GARY and are part of the Floppy Functions.

Signal, *DKRD is connected to the External Floppy Port (CN5)

Signals *TXD, *RXD, are connected to U38 and U39 respectively and are part of the RS232 Functions.

Signals AUD B (RIGHT), AUD A (LEFT) are connected to U14 and are part of the Audio Out Functions.

U10 : 74LS244 : NON - INVERTING BUFFER/LINE DRIVER/RECEIVER

PINS

2,18 : D0 4,16 : D1 6,14 : D2 8,12 : D3
11,9 : D4 13,7 : D5 15,5 : D6 17,3 : D7
1,19 : *DEB,U5(4) 10 : GND 20 : +5v

U11 : 74LS373 : D - TYPE LATCH

PINS

2,3 : D0 4,5 : D1 6,7 : D2 8,9 : D3
12,13 : D4 14,15 : D5 16,17 : D6 18,19 : D7
1 : *DEL,U5(3) 11 : *LATCH,U5(25)
10 : GND 20 : +5v

U12 : 74LS244 : NON - INV.BUFFER/LINE DRIVER/RECEIVER

PINS

2,18 : D8 4,16 : D9 6,14 : D10 8,12 : D11
9,11 : D12 7,13 : D13 5,15 : D14 3,17 : D15
1,19 : *DEB,U5(4) 10 : GND 20 : +5v

U13 : 74LS373 : D - TYPE LATCH

PINS

2,3 : D8 4,5 : D9 6,7 : D10 8,9 : D11
12,13 : D12 14,15 : D13 16,17 : D14 18,18 : D15
1 : *DEL,U5(3) 11 : *LATCH,U5(25)
10 : GND 20 : +5v

U14 : LF347/TL084

IN AUDIO OUT (LEFT & RIGHT) FILTER CIRCUITS

U15 : 74LS157 : LINE DATA SELECTOR

IN JOYSTICK LEFT (CN1) & RIGHT (CN2) CONTROL CIRCUIT

U16 - U32 : 256K DYNAMIC RANDOM ACCESS MEMORY (RAM)

PINS

5 : A0 7 : A1 6 : A2 12 : A3 11 : A4 10 : A5
13 : A6 9 : A7 1 : A8
3 : *WE,U35(3) 4 : *RAS,U35(5) 15 : *CAS,U35(12)
2,14 : DATA LINES (SEE BELOW)

D0:U16 D1:U17 D2:U18 D3:U19 D4:U20 D5:U21 D6:U22
D7:U23 D8:U24 D9:U25 D10:U26 D11:U27 D12:U28 D13:U29
D14:U30 D15:U31

U32 : 74E74 : D-TYPE BISTABLE (FAST)

U33 : 74F04 : HEX INVERTER (FAST)

USED IN CLOCK CIRCUIT INTERFACING

U34 : NON - INV.BUFFER/LINE DRIVER/RECEIVER (FAST) 74F244

USED IN DATA LINE INTERFACING TO RAM I.C.'s.

PINS

4,16:D0 8,12:D1 6,14:D2 3,17:D3 5,15:D4 7,13:D5 2,18:D6
9,11:D7 1,19:GND,20 : +5v

U35 : NON INV.BUFFER/LINE DRIVER/RECEIVER (FAST) 74F244

USED IN ONE DATA LINE INTERFACE TO RAM I.C.'s (D8) AND THE
COLUMN AND ROW ADDRESS STROBES TO RAM I.C.'s AND READ/WRITE
TO THE RAMS..

PINS

1,9:D8 8,12:*CASL,U2(54) 7,13:*CASU,U2(55)
5,15:*RAS0,U2(57) 2,18:*RAS1,U2(56) 3,17:*WE,U2(21)
1,19:GND 4,6:GND 20 : +5v

U36 : 74LS38 : NAND BUFFER

INTERFACING TO INTERNAL AND EXTERNAL FLOPPY DRIVES (CONTROL)

SEE U5 GARY CHART

U37 : 74LS32 : 2 - INPUT OR GATE

USED IN CHIP SELECT CONTROL ON U7 & U8 8520 CIA's (PIN 23)

ALSO IN RESET ACTION CIRCUIT *RST to *IORESET,CN5(10)CN7(16)
AND *RESET,U7 & U8(34)

U38 : 1488 LINE DRIVER

USED IN RS232 SERIAL PORT CIRCUIT

U39 : 1489 RECEIVER

USED IN RS232 SERIAL PORT CIRCUIT

U40 & 41 : NON - INV.BUS TRANSCEIVER

USED IN VIDEO CIRCUIT, U4 DENISE to U40 & U41 to HY1 VIDEO
HYBRID CHIP and CN9 VIDEO PORT

U42 : NE555

USED IN RESET ACTION CIRCUIT.GENERATES *KBRESET SIGNAL

DATA LINE CHART

	U1	U3	U4	U6	U7	U8	U10	U11	U12	U13	U34
D0	5	10	7	13	33	33	2&18	2&3			4&16
D1	4	9	6	15	32	32	4&16	4&5			8&12
D2	3	7	5	17	31	31	6&14	6&7			6&14
D3	2	6	4	19	30	30	8&12	8&9			3&17
D4	1	5	3	22	29	29	9&11	12&13			5&15
D5	64	4	2	24	28	28	7&13	14&15			7&13
D6	63	3	1	26	27	27	5&15	16&17			2&18
D7	62	2	48	28	26	26	3&17	18&19			9&11
D8	61	1	47	14					2&18	2&3	
D9	60	48	46	16					4&16	4&5	
D10	59	47	45	18					6&14	6&7	
D11	58	46	44	20					8&12	8&9	
D12	57	45	43	23					9&11	12&13	
D13	56	44	42	25					7&13	14&15	
D14	55	43	41	27					5&15	16&17	
D15	54	42	40	29					3&17	18&19	

ALSO D8 : U35 (1&9) ..

SEE U16 - U32 CHART FOR DRAM DATA CONNECTIONS

NOTE

NUMBER IN MATRIX REFERS TO PIN NUMBER ON THE I.C.

ADDRESS LINE CHART

	U1	U2	U5	U6	U7	U8	DRAMS(U16 - U32)
A0				9			5
A1	29	60		8			7
A2	30	61		7			6
A3	31	62		6			12
A4	32	63		5			11
A5	33	64		4			10
A6	34	65		3			13
A7	35	66		2			9
A8	36	67		40	38	38	1
A9	37	68		39	37	37	
A10	38	69		38	36	36	
A11	39	70		37	35	35	
A12	40	71		36			
A13	41	72		35			
A14	42	73		34			
A15	43	74		33			
A16	44	75		32			
A17	45	76	33	31			
A18	46	77	34				
A19	47	59	35				
A20	48		36				
A21	50		37				
A22	51		38				
A23	52		39				

NOTE

NUMBERS IN MATRIX REFER TO PIN NUMBER ON THE I.C.